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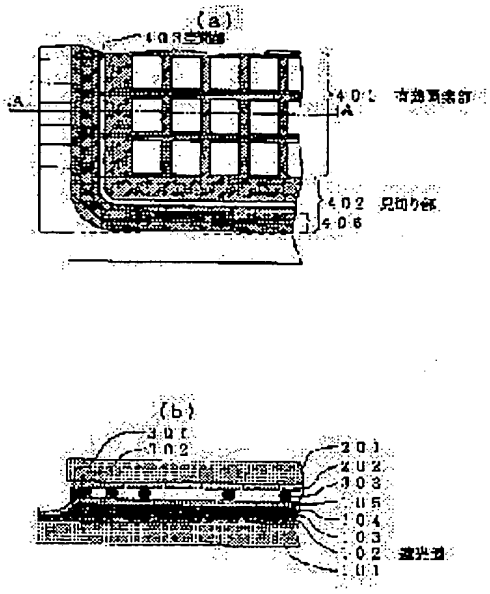
(54) LIQUID CRYSTAL DISPLAY PANEL

(57)Abstract:
PURPOSE: To provide the liquid crystal display panel which has excellent flatness, has a sufficient light shielding characteristic and provides high display quality by providing the light shielding film in a parting part with a space part and sealing the space part with the parting part on the outer side thereof.
CONSTITUTION: A chromium thin film is first formed by using a sputtering method or vacuum vapor deposition method over the entire surface of a first substrate 101. This chromium thin film is formed to prescribed patterns by using a photoetching method and is provided with the light shielding film 102. The flat pattern shape of this light shielding film 102 is provided with the space part 403 in the parting part 402. The sealing part 406 for sealing a first substrate 101 and a second substrate 201 are disposed on the side outer than the effective pixel part 401 of the space part 403. The light shielding films of the effective pixel part 401 and the sealing part 406 are electrically separated. The transparent electrodes 105 and the sealing part 406 of the light shielding film 102 are electrically separated in such a manner and, therefore, the influence of the electrical shorting between the transparent electrode 105 and the light shielding film 102 is not transmitted to the effective pixel part 401 even if such an electrical short arises.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention still more specifically relates to the structure of a substrate where the shading film which has conductivity was prepared, about the structure of the substrate of a liquid crystal display panel. Although structure may change separately with differences in the mode of monochrome, a color, an active type, a passive type or TN type, a STN type, a strong dielectricity type, and an antiferroelectric type and others etc., this invention can respond to any mode. The following explanation explains a STN, passive type, and electrochromatic display display panel as a representative.
[0002]
[Description of the Prior Art] Fundamentally, a liquid crystal display panel makes the field which formed the transparent electrode for two substrates in which two or more transparent electrodes were formed counter, is closed by the sealant, and pours in and constitutes liquid crystal material between these two substrates.
[0003] Based on a drawing, the conventional technology is explained below. Drawing 4 (a) is the plan showing the structure of the conventional STN electrochromatic display display panel. Drawing 4 (b) is the cross section showing the cross section in the D-D line of drawing 4 (a). In addition, in drawing 4 (a), the light filter 103 prepared in the 1st substrate and the transparent electrode 202 prepared in the 2nd substrate are omitted in order to make a drawing legible.
[0004] As shown in drawing 4 (b), the shading film 102 is formed on the 1st substrate 101, a light filter 103 is formed on the shading film 102, a protective coat 104 is formed on this light filter 103, and the transparent electrode 105 is formed on the protective coat 104.
[0005] And the transparent electrode 202 is formed on the 2nd substrate 201 which counters the 1st substrate 101. In addition, illustration is omitted although the orientation film is prepared in fact on the transparent electrode 105 and the transparent electrode 202.
[0006] These the 1st substrate 101 and 2nd substrate 201 are closed by the sealant 301 in the circumference. The field where this sealant 301 is arranged is called seal section after this.
[0007] In addition, in order to make uniform the gap of the 1st substrate 101 and the 2nd substrate 202, the internal spacer 303 is formed inside the seal section, and the spacer 302 in a seal is mixed in the sealant. As a spacer of the section spacer 303 and the spacer 302 in a seal, a globular form silica bead and a globular form, globular form plastics bead, pillar-like glass fiber, etc. are used among these.
[0008] As an internal spacer 303 formed in the portion inside the seal section, a globular form silica bead and a globular form, globular form plastics bead are used, and, generally a stiff silica bead and glass fiber are used in the spacer 302 in a seal of a sealant 301.
[0009] Moreover, in order to make the gap of two substrates uniform, substrate structure of the seal section is made as uniform as possible, and the consideration which makes flat the front face of the 1st substrate 101 and the 2nd substrate 201 is made.
[0010] The shading film 102 is explained here. A transparent electrode 105 and a transparent electrode 202 are mutually arranged in the shape of a matrix, and are a pixel portion to which the portion which counters participates in a display, and other portions are non-pixel portions which do not participate in a display. In order not to reduce the contrast of the whole display, as for a non-pixel portion, it is desirable for a light transmittance to be zero.
[0011] However, since light leaks for various reasons in fact, display quality will be demoted remarkably. Then, the device which prevents the optical leakage from a non-pixel portion is tried.
[0012] There are some which a ****** light filter tends to be made to overlap in the non-pixel section as 1st conventional example, and are going to acquire the shading effect. However, the optical leakage of some arises also in the portion which overlapped the light filter, and the perfect shading effect is not acquired.
[0013] However, with this means, the shading effect is not acquired only to the non-pixel section parallel to a light filter, and the non-pixel section which intersects perpendicularly with a light filter cannot be shaded.
[0014] The 2nd conventional example is explained using drawing 4 (a) and drawing 4 (b). In the structure shown

in drawing 4 (a) and drawing 4 (b), the shading film 102 is formed independently in the light filter 103.
[0015] By constituting the configuration of the shading film 102 in the shape of parallel crosses, the shading effect is acquired also to a non-pixel portion parallel to a light filter 103, and the shading effect can be acquired also to the non-pixel portion which intersects perpendicularly with a light filter 103 further.
[0016] moreover, since the shading film 102 is formed independently with a light filter 103, a shading film can be simultaneously prepared not only in the shading effect of the non-pixel section in the pixel section which participates in a display, and the non-pixel section between the pixel (it is henceforth called the effective pixel section 401) but in the sacrifice section 402 which is the boundary region of the effective pixel section 401
[0017] In the sacrifice section 402, leading-about wiring which connects the drive semiconductor integrated circuit equipment for driving the liquid crystal display panel of the pixel section and the exterior by the transparent electrode is performed.
[0018] This sacrifice section 402 as well as the non-pixel portion in the effective pixel section 401 caused optical leakage, and has demoted the display quality of a liquid crystal display panel.
[0019] Although a shading sheet is installed independently or the shading film is printed on a windshield in order to prevent the optical leakage of this sacrifice section 402 when making the product which used the liquid crystal display panel, the problem of position precision cannot be and be satisfied.
[0020] Thus, with the thickness of the 1st substrate 101 or the 2nd substrate 201, if the member for preventing optical leakage is made from a member different from a liquid crystal display panel and is carried out every exception, when it sees from across, optical leakage will be caused.
[0021] Optical leakage is not caused, even when it sees from across, in order in the case of the structure shown in the 2nd conventional example to be able to prepare with a precision sufficient to the interior of a liquid crystal display panel and to prepare in the interior of a liquid crystal display panel.
[0022] There is the method of forming the black resin which distributed the black pigment which is an insulating material, and the black color as the formation method of the shading film 102 by print processes or the photo etching method. However, the absorbance of this black resin material is low, and when thickness is thin, sufficient shading property is not acquired.
[0023] In order to acquire shading property sufficient by this black resin, it is necessary to make thickness of a resin thick enough. However, when thickness of a black resin is thickened in this way, it is difficult for a big surface level difference to arise in the portion of the shading film 102, and the portion of the pixel section, and to carry out flattening of this surface level difference by the protective coat 104.
[0024] Thus, the liquid crystal display panel with the substrate structure for which flat nature was insufficient will start the orientation ununiformity of liquid crystal, and will become what has bad display quality. In order to solve this problem, a metal thin film with shading property sufficient as a material of the shading film 102 is used.
[0025] The manufacturing process of the conventional structure shown in drawing 4 (a) at the time of using a metal thin film for the shading film 102 and drawing 4 (b) is explained briefly.
[0026] The whole surface on the 1st substrate 101, by the sputtering method or the vacuum deposition method, after forming opaque metal thin films, such as chromium, a pattern predetermined by the photo etching method is formed, and it considers as the shading film 102.
[0027] On the shading film 102, print processes, a staining technique, a pigment-content powder method, etc. are used, and a light filter 103 is formed.
[0028] Furthermore, on the light filter 103, print processes and the spin coat method are used for transparent resins, such as a polyimide and an acrylic, and a protective coat 104 is formed.
[0029] Then, the oxidization in JUUMU tin film which uses the sputtering method, a vacuum deposition method, etc. and serves as a transparent electrode 105 is formed on a protective coat 104. A pattern configuration predetermined by the photo etching method is processed, and let this oxidization in JUUMU tin film be a transparent electrode 105.
[0030] When the shading film 102 is made into a metal thin film, in addition to planation, the operation as an insulator layer between the shading film 102 and a transparent electrode 105 will also have a protective coat 104 as mentioned above.
[0031]
[Problem(s) to be Solved by the Invention] The thing which were described above and for which a metal thin film is used as a shading film 102 like is a realistic method of giving sufficient shading property and moreover securing the flat nature of the front face of a transparent electrode 105. It is also the advantage that detailed pattern processing can do this metal thin film by the photo etching method.
[0032] Moreover, since the shading film 102 is formed independently with a light filter 103, it can form the shading film 102 not only in the shading effect of the non-pixel section in the effective pixel section 401 but in the sacrifice section 402 of the effective pixel section circumference simultaneously.
[0033] However, when a metal thin film is used as a shading film 102, electric short-circuit often takes place between the shading film 102 and a transparent electrode 105, the luminosity of the pixel corresponding to this

electric short transparent electrode 105 that happened changes, a liquid crystal display panel becomes poor, and the trouble of reducing the yield greatly occurs.
[0034] Originally, it should insulate electrically between the shading film 102 and the transparent electrode 105 by the protective coat 104. If the above-mentioned electric short generating place is pinpointed, the many will be generated in the seal section 406 which closes the 1st substrate 101 and 2nd substrate 201.
[0035] now about this cause, it is ** -- or -- although -- it thinks as follows A liquid crystal display panel arranges the internal spacer 303 to the inside which mixes the spacer 302 in a seal into the sealant 301 of the seal section 406, and is surrounded by the sealant 301 of a liquid crystal display panel, in order to make uniform the gap of the 1st substrate 101 and the 2nd substrate 201.
[0036] Then, a sealant 301 is hardened, pressurizing so that the 1st substrate 101 and 2nd substrate 201 of each other may be forced.
[0037] In case [this] it hardens pressurizing, it overlaps, or the force concentrates on the spacer 302 in a seal which was being condensed, a protective coat 104 is broken through through the transparent electrode 105 on the 1st substrate 101, a transparent electrode 105 touches the shading film 102, and electric short-circuit is generated.
[0038] The place made into the purpose of this invention prevents the trouble which comes from electric short-circuit with the above-mentioned shading film and a transparent electrode, and is to be stabilized and supply the high liquid crystal display panel of display quality.
[0039]
[Means for Solving the Problem] 1st means by which this invention uses in order to attain the above-mentioned purpose is a thing which prepared around the effective pixel section and which it abandons, and the space section is prepared in the shading film of the section, and is done for a seal in the sacrifice section of the outside of the space section, and the 2nd means is preparing a slit in the shading film of the sacrifice section of the outside of the space section.
[0040]
[Function] Since the shading film is separated with the effective pixel section even if electric short-circuit with a transparent electrode and a shading film occurs in the seal section, a display is not affected for the liquid crystal display panel constituted using the above-mentioned means.
[0041] Consequently, without reducing the yield, it can excel in flat nature, and can have sufficient shading property, and the liquid crystal display panel which has high display quality can be offered.
[0042]
[Example] A drawing explains the example of this invention below. In addition, the following drawings do not show only structure and do not show a size etc.
[0043]
[Example 1] Drawing 1 (a) is the plan showing the liquid crystal display panel in the 1st example of this invention. Drawing 1 (b) is the cross section showing the cross section in the A-A line in drawing 1 (a). In addition, illustration is omitted in order that a light filter 103 and the transparent electrode 202 on the 2nd substrate 201 may make a drawing legible in drawing 1 (a).
[0044] As shown in drawing 1 (b), the whole surface on the 1st substrate 101, the sputtering method or a vacuum deposition method is used first, and a chromium thin film is formed. This chromium thin film is formed in a predetermined pattern using the photo etching method, and the shading film 102 is formed.
[0045] The flat-surface pattern configuration of this shading film 102 provides the space section 403 in the sacrifice section 402, as shown in drawing 1 (a).
[0046] And the seal section 406 which closes the 1st substrate 101 and 2nd substrate 201 is formed outside to the effective pixel section 401 of the space section 403.
[0047] The shading film of the effective pixel section 401 and the seal section 406 is electrically separated by this space section 403.
[0048] Thus, since the electric short seal section of a transparent electrode 105 and the shading film 102 which occur frequently is separated electrically, even if electric short-circuit with a transparent electrode 105 and the shading film 102 occurs, the influence will not get across to the effective pixel section 401.
[0049] Since the width-of-face size of this space section 403 just performs electric separation, its narrower one is good. And if the width-of-face size of the space section 403 is too large not much conversely, since its optical leakage from this space section 403 will increase, its effect as the sacrifice section decreases.
[0050] Then, on the shading film 102, a staining technique is used and the direct light filter 103 is formed. Furthermore, after that, on a light filter 103, the spin coat method is used, transparent acrylic resin is applied, and a protective coat 104 is formed.
[0051] Furthermore, on a protective coat 104, by the sputtering method, after forming an oxidization in JUUMU tin thin film, a pattern predetermined by the photo etching method is formed, and a transparent electrode 105 is formed.
[0052] Thus, pressurization closure of the 1st mad substrate 101 and the 2nd substrate 201 which formed the

transparent electrode 202 is carried out by the sealant 301 which mixed the spacer 302 in a seal, and a liquid crystal display panel is built.
[0053] The liquid crystal display panel made into 5 microns based on the 1st example of this invention as a width-of-face size of the space section 403 of the shading film 102 was created. Consequently, there is no generating of the pixel which changed the electric luminosity of a transparent electrode 105 and the shading film 102 depended short, and it was able to do the high thing of display quality.
[0054] Moreover, the optical leakage from the space section 403 prepared in the shading film 102 of the sacrifice section 402 is very few, and was able to be used as abandonment without sense of incongruity.
[0055] That is, the 1st example shown in drawing 1 (a) and drawing 1 (b) forms the space section 403 in the sacrifice section 402 of the shading film 102 which has the conductivity established on the 1st substrate 101, and has the structure which carries out seal closure in the seal section 406 of the outside of the space section 403 to the effective pixel section 401.
[0056] If the structure shown in this drawing 1 (a) and drawing 1 (b) is adopted, although there is conductivity as a shading film 102, even if it uses metal thin film with a sufficient shading property, the seal section and the pixel section are electrically separated by the space section 403 prepared in the sacrifice section 402. For this reason, even if electric short-circuit with a transparent electrode 105 and the shading film 102 occurs in the seal section 406, the influence on the pixel section can be prevented.
[0057]
[Example 2] Drawing 2 (a) is the plan showing the liquid crystal display panel in the 2nd example of this invention. Drawing 2 (b) is the cross section showing the cross section in the B-B line in drawing 2 (a). In addition, in drawing 2 (a), in order that the transparent electrode 202 prepared in a light filter 103 and the 2nd substrate 201 may make a drawing legible, illustration is omitted.
[0058] As shown in drawing 2 (b), the whole surface on the 1st substrate 101, the sputtering method or a vacuum deposition method is used first, and a chromium thin film is formed. This chromium thin film is formed in a predetermined pattern using the photo etching method, and the shading film 102 is formed.
[0059] The flat-surface pattern configuration of this shading film 102 provides the space section 403 in the sacrifice section 402, as shown in drawing 2 (a). Furthermore, the slit 404 is formed in the sacrifice section 402 of the outside of the space section 403.
[0060] This slit 404 is formed in the form where the shading film 102 of the outside of the space section 403 is separated corresponding to the transparent electrode 105 prepared on the 1st substrate 101.
[0061] The seal section 406 which closes the 1st substrate 101 and 2nd substrate 201 is formed outside to the effective pixel section 401 of the space section 403.
[0062] The shading film 102 of the sacrifice section 402 under the effective pixel section 401 and the seal section 406 is electrically separated by this space section 403.
[0063] Thus, since the electric short seal section of a transparent electrode 105 and the shading film 102 which occur frequently is separated electrically, even if electric short-circuit with a transparent electrode 105 and the shading film 102 occurs, the influence will not get across to the effective pixel section 401.
[0064] Moreover, by the slit 404 prepared corresponding to the transparent electrode 105, even if electric short-circuit with the shading film 102 occurs in two or more transparent electrodes 105, electric short generating through transparent-electrode 105 comrade's shading film 102 can also be prevented.
[0065] Since this space section 403 and the width-of-face size of a slit 404 just perform electric separation, its narrower one is good. And if the width-of-face size of the space section 403 and a slit 404 is too large not much conversely, since the optical leakage from the space section 403 and a slit 404 increases, its effect as the sacrifice section will decrease.
[0066] Then, on the shading film 102, a staining technique is used and the direct light filter 103 is formed. Furthermore, after that, on a light filter 103, the spin coat method is used, transparent acrylic resin is applied, and a protective coat 104 is formed.
[0067] Furthermore, on a protective coat 104, by the sputtering method, after forming an oxidization in JUUMU tin thin film, a pattern predetermined by the photo etching method is formed, and a transparent electrode 105 is formed.
[0068] Thus, pressurization closure of the 1st made substrate 101 and the 2nd substrate 201 which formed the transparent electrode 202 is carried out by the sealant 301 which mixed the spacer 302 in a seal, and a liquid crystal display panel is built.
[0069] The liquid crystal display panel which made 5 microns the space section 403 of the shading film 102 and the width-of-face size of a slit 404 based on the 2nd example of this invention was created. Consequently, the high thing of the electric short display quality of transparent-electrode 105 comrade who generating of the pixel which changed the electric luminosity of a transparent electrode 105 and the shading film 102 depended short does not have, either, and minds the shading film 102 which is not was made.
[0070] Furthermor , the optical leakage from the space section 403 which was abandoned and was prepared in the shading film 102 of the section 402, and a slit 404 is very few, and was able to be used as abandonment

without sense of incongruity.
[0071] That is, the 2nd example shown in drawing 2 (a) and drawing 2 (b) forms the space section 403 in the sacrifice section 402 of the shading film 102 which has the conductivity established on the 1st substrate 101, and has formed the slit 404 in the shading film 102 of the sacrifice section 402 of the outside of the space section 403.
[0072] Corresponding to the transparent electrode 105 prepared on the 1st substrate 101, this slit 404 is the sacrifice section 402 of the outside of the space section 403, and is prepared in the form where the shading film 102 is separated. And it has the structure which carries out seal closure in the seal section 406 of the outside of the space section 403 to the 1st substrate 101, 2nd substrate 201, and effective pixel section 401.
[0073] If the structure shown in this drawing 2 (a) and drawing 2 (b) is adopted, although there is conductivity as a shading film 102, even if it uses metal thin film with a sufficient shading property, the seal section and the pixel section are electrically separated by the space section 403 prepared in the sacrifice section 402. For this reason, even if electric short-circuit with a transparent electrode 105 and the shading film 102 occurs in the seal section, the influence on the pixel section can be prevented.
[0074] Moreover, by the slit 404 prepared corresponding to the transparent electrode 105, even if electric short-circuit with the shading film 102 occurs in two or more transparent electrodes 105, electric short generating through transparent-electrode 105 comrade's shading film 102 can also be prevented.
[0075]
[Example 3] Drawing 3 (a) is the plan showing the liquid crystal display panel in the 3rd example of this invention. Drawing 3 (b) is the cross section showing the cross section in the C-C line in drawing 3 (a). In addition, illustration is omitted in order that the transparent electrode 202 prepared in a light filter 103 and the 2nd substrate 201 in drawing 3 (a) may make a drawing legible.
[0076] As shown in drawing 3 (b), the whole surface on the 1st substrate 101, the sputtering method or a vacuum deposition method is used first, and a chromium thin film is formed. This chromium thin film is formed in a predetermined pattern using the photo etching method, and the shading film 102 is formed.
[0077] The flat-surface pattern configuration of this shading film 102 provides the space section 403 in the sacrifice section 402, as shown in drawing 3 (a).
[0078] Furthermore, the slit 404 is formed in the sacrifice section 402 of the outside of the space section 403. This slit 404 is formed in the form where the sacrifice section of the outside of the space section 403 is separated, corresponding to the transparent electrode 105 prepared on the 1st substrate 101.
[0079] A slit 405 is formed over seal section 406 perimeter of a liquid crystal display panel with the same numerical aperture as the slit 404 furthermore prepared corresponding to the transparent electrode 105. That is, surface ratio of a slit 404 and a slit 405 is made the same.
[0080] The seal section 406 which closes the 1st substrate 101 and 2nd substrate 201 is [0081] prepared outside to the effective pixel section 401 of the space section 403. Then, on the shading film 102, a staining technique is used and the direct light filter 103 is formed. Furthermore, after that, on a light filter 103, the spin coat method is used, transparent acrylic resin is applied, and a protective coat 104 is formed.
[0082] After forming an oxidization in JUUMU tin thin film by the sputtering method on a protective coat 104 furthermore, a pattern predetermined by the photo etching method is formed, and a transparent electrode 105 is formed.
[0083] Thus, pressurization closure of the 1st made substrate 101 and the 2nd substrate 201 which formed the transparent electrode 202 is carried out by the sealant 301 which mixed the spacer 302 in a seal, and a liquid crystal display panel is built.
[0084] The liquid crystal display panel which made 5 microns the space section 403 of the shading film 102 and the width-of-face size of slits 404 and 405 based on the 3rd example of this invention was created. Consequently, the high thing of the electric short display quality of transparent-electrode 105 comrade who generating of the pixel which changed the electric luminosity of a transparent electrode 105 and the shading film 102 depended short does not have, either, and minds the shading film 102 which is not was made.
[0085] Moreover, from the slit 405 prepared over seal section 406 perimeter of a liquid crystal display panel, over the perimeter, the optical leakage from the seal section 406 is homogeneity, and its homogeneity of the gap of the 1st two about 406 seal section substrates 101 and the 2nd substrate 201 also improved.
[0086] The optical leakage from the space section 403 prepared in the shading film 102 of the sacrifice section 402 and slits 404 and 405 is very few, and was able to be used as abandonment without sense of incongruity.
[0087] Namely, the 3rd example shown in drawing 3 (a) and drawing 3 (b) Form the space section 403 in the sacrifice section 402 of the shading film 102 which has the conductivity established on the 1st substrate 101, and it sets in the seal section of the outside of the space section 403 to the effective pixel 401. Corresponding to a transparent electrode 105, a slit 404 is formed in the shading film 102, and it has further the structure which formed the aforementioned slit 404 and the slit 405 of the same numerical aperture in the seal section perimeter of a liquid crystal display panel.
[0088] According to the 3rd example of this invention with the structure shown in drawing 3 (a) and drawing 3

(b), although there is conductivity as a shading film 102, even if it uses metal thin film with a sufficient shading property, the effective pixel section 401 is electrically separated with the seal section 406 by the space section 403 prepared in the shading film 102 of the sacrifice section 402. For this reason, even if electric short-circuit of a transparent electrode 105 and the shading film 102 occurs in the seal section 406, the influence on the effective pixel section 401 can be prevented.

[0089] Moreover, the shading film 102 is separated by the slit 404 corresponding to each transparent electrode 105. For this reason, even if electric short-circuit with two or more transparent electrodes 105 and the shading film 102 occurs, the electric short-circuit through transparent-electrode 105 comrade's shading film 102 can also be prevented.

[0090] Moreover, since a slit 405 is formed and it is over the perimeter of the seal section of a liquid crystal display panel with the same numerical aperture as a slit 404, the controllability of the gap of two substrates is good for the shading film 102 of the sacrifice section 402.

[0091] Since it furthermore abandons and adjustment of the amount of optical leakage from the section 402 is also carried out, a liquid crystal display panel with sufficient display quality can be offered.

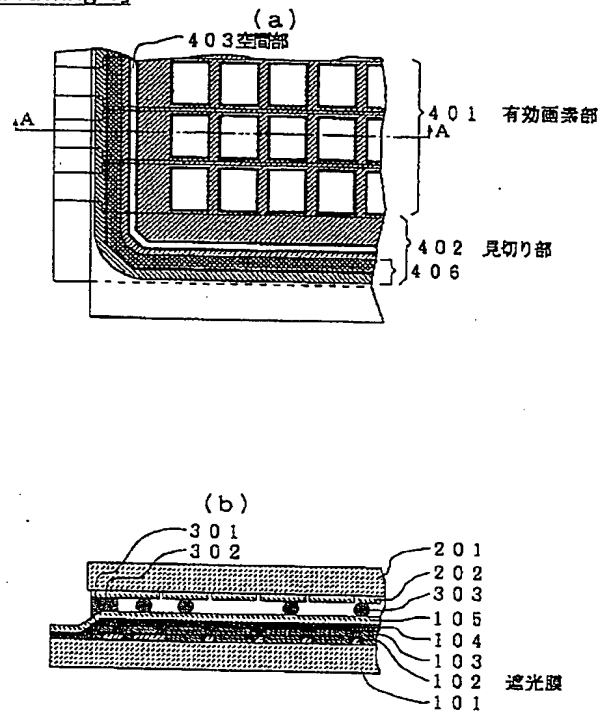
[0092]

[Effect of the Invention] the above explanation -- the Ming kana -- this invention has the pixel section and the structure to separate electrically like in the liquid crystal display panel which has a shading film with conductivity to the space section which prepared the electric short seal section of a shading film and a transparent electrode which occur frequently in the shading film, and a slit Thereby, even if electric short-circuit of a shading film and a transparent electrode occurs in the seal section, the influence can be separated from the effective pixel section.

[0093] For this reason, it is not necessary to use an insulator with an inadequate shading property as a shading film, and it excelled in the shading property and the high liquid crystal display panel of the display quality excellent in flat nature can be produced.

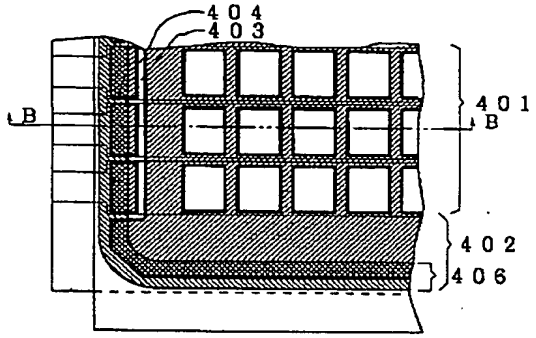
DRAWINGS

[Drawing 1]



[Drawing 2]

(a)



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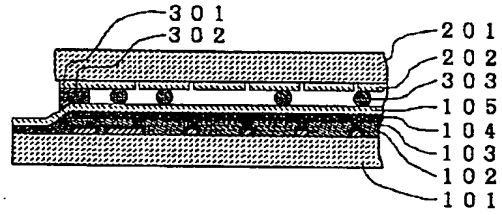
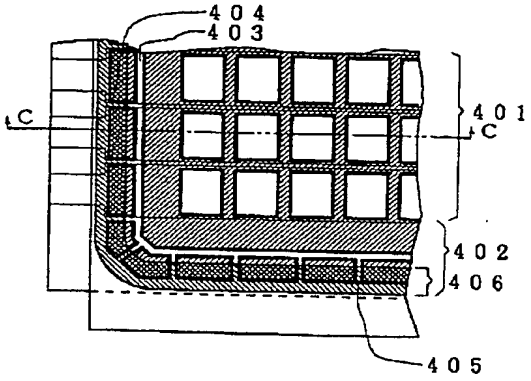


[Drawing 3]

(a)



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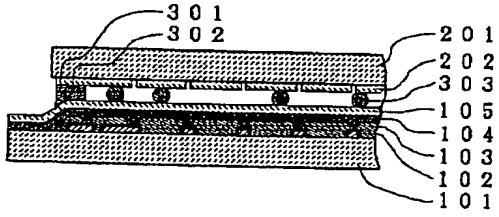
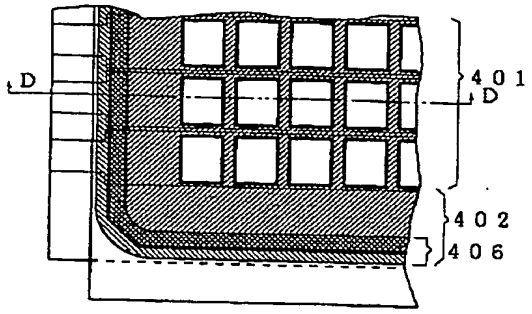


[Drawing 4]

(a)



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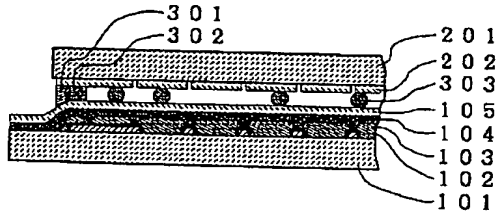

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